



The Boxing Conundrum: Is there a place for a new variant of the sport?

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Received 01September, 2014; Accepted 10September, 2014 © The author(s) 2014. Published with open access at www.questjournals.org

ABSTRACT:-The purpose of this review is to establish current knowledge in regard to the legal, medical, ethical and moral concerns of participating in boxing. The review also presents a case for boxing by highlighting the social and physical benefits associated with participation. It summarises, interprets, and critically evaluates the existing literature and introduces a safer alternative Box'Tag.

KEYWORDS:-Boxing, Box'Tag, Community participation, Low-risk modified boxing, Modified sports, Sport for development

I. INTRODUCTION

Boxing is a controversial sport. It has equally passionate proponents and opponents. Since the late 19th century, it has evolved into two different forms – professional and amateur boxing [1]. Both have gradually changed in response to internal perceptions of need for improvement and external criticisms, but remain subject to spirited medical, legal, moral and ethical debate. A question arises as to whether scope exists to develop a new variant of boxing that would be more broadly acceptable. This paper aims first to clarify the context of the question and then insofar as possible to resolve it.

II. BACKGROUND

Boxing has a long history, with a form having been included in the Ancient Olympics [2]. Modern versions can be traced back to 1681, when the first documented professional contest took place in England [3]. In the years thereafter, the sport flourished, despite initially being illegal. By 1698, contests were sometimes held at the Royal Theatre of London. Participants vied for prize-money that was often supplemented by side-bets. They usually fought with bare knuckles and there were very few constraints. Contests typically continued until one participant was rendered incapable of doing so. They were often between people of markedly different size [3].

The first standard rules were introduced in 1743 [4]. They prohibited striking a contestant who was 'down' and provided for the match to be automatically concluded if this contestant was unable to rise after 30 seconds. Also in the mid-18th century, gloves known as 'mufflers' were developed [5], but their use was not mandated. The sport remained highly dangerous, with a number of deaths occurring [6]. This provided the stimulus for development of a new set of rules in 1838, and a revision in 1853 [2]. Among the principal changes were the introduction of a square 'ring' surrounded by ropes and the prohibition of biting, head-butting and hitting below the waist. At about the same time, the first efforts to introduce weight classes occurred.

In 1867, the 'Queensberry Rules for the sport of boxing' were published [7]. The use of 'fair-size' gloves was made compulsory and contests were limited to a 'defined number of 3-minute rounds' separated by 1-minute rest intervals. Wrestling was banned and a match was deemed to be over if a boxer remained down for 10 seconds.

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The Queensberry Rules were not only largely adopted in professional boxing, but also spurred the development of an amateur version of boxing that had been initiated a few years earlier. Queensberry Amateur Boxing Championships were held from 1867 to 1885 [8]. In 1880, the Amateur Boxing Association was formed in England, with twelve member clubs. Its first championships were held the following year, with four weight classes contested [8]. From that time onwards, the amateur and professional forms of the sport diverged.

Historically, professional boxing has attracted substantial media attention and a wide public following. It has become big business, with reports that boxers have received purses in excess of USD 50 million for single world championship bouts [9] and that vast fortunes have been amassed also by entrepreneurial promoters of professional boxing events [10]. There is a strong focus on public entertainment and television appeal. A recent world championship contest was watched live by a worldwide television audience of 2.5 million people and generated television pay-per-view revenue of USD 150 million [9]. In addition, a bout held in 1988 is said to have produced gambling revenues of over USD 340 million in the host city alone [11].

Various developments have occurred that could be seen as being driven at least partly by desire for profit. For example, there has been a proliferation of weight divisions, with 17 now widely accepted [12], and more than a dozen different organisations currently sanction and conduct their own professional world championship bouts [13]. This means that there are typically multiple champions in each division.

Throughout the 20th century, most professional championship bouts were scheduled for 15 three-minute rounds, but in recent years the maximum duration has been shortened to 12 rounds with a view to improving safety [14]. It is quite common for a bout to be concluded in less than the scheduled time because of inability of one contestant to continue. Balmer et al. [15] reported that of 788 European championship contests held between 1910 and 2002, 50% ended in a knockout or technical knockout.

Amateur boxing has differed markedly from professional boxing in that its development generally has not been driven by the forces of capitalism. Rather, it has its origins in an attempt to make a form of the sport available to people wanting to use it as a vehicle for physical and personal development and the pursuit of virtue. In its early stages, it was derided as an attempt by people of relatively high socio-economic status to access and influence the course of an inherently working-class sport, but it was able to gain uptake in such settings as schools and universities [8]. Until very recently, there has been no prize money and the administration of the sport has been geared more toward providing a service to participants [16] than to overt profit-making. Amateur boxing has been included in all but one Summer Olympic Games since 1904 [8] and this has provided its primary means for public exposure. Internationally, it has remained under the control by a single organisation, the International Boxing Association (formerly the Association Internationale de Boxe Amateur), which subscribes to the Olympic charter. There are currently 10 weight divisions for senior athletes [12]. Since the inception of amateur boxing, bouts generally have been restricted to three or four rounds. Other rules aimed at limiting the probability of injury also have been implemented [17]. For example, the gloves used in amateur boxing have typically incorporated more padding than those employed in professional boxing. In 1984 it became mandatory for amateur boxers to wear head guards during competition, and in 2002 a new rule allowed for a bout to be rapidly stopped if a contestant was seen to be ‘outclassed’ by an opponent.

As testament to the apparent effectiveness of the safety measures, almost 93% of the boxing contests at the 2008 Beijing Olympic Games were decided on points [18].

Presently, though, amateur boxing is undergoing major change. Within the past five years, the International Boxing Association has implemented a range of actions that it believes will increase the attractiveness of the sport [17]. It has mandated that senior male boxers will no longer wear head guards. The age limit for participation in amateur boxing has been raised from 34 to 40 years. The scoring system has been made similar to that used in professional boxing. A televised World Series of Boxing competition has been introduced and involves teams run by organisations that pay the International Boxing Association for franchises. Bouts held as part of the World Series are contested over five 3-minute rounds, with prize money on offer. The International Boxing Association has also established a professional division that allows for bouts of up to 12 rounds and will effectively enable boxers to compete as full professionals but remain eligible to take part in the Olympic Games [19]. Women’s boxing has been added to the Olympic Games program [17]. Many of the changes appear aimed at capturing a major share of the market currently associated with professional boxing. It is arguable that after more than 130 years of separation, amateur and professional boxing are now converging [19] under the influence of a high-level commercial focus.

A question arises as to whether the contemporary changes in amateur boxing are creating a place for a new form of the sport that is underpinned by the philosophy and quest for safety that amateur boxing originally represented. The answer is by no means certain, particularly as amateur boxing, following a period of decreasing popularity, is currently undergoing resurgence. In the UK, the number of people registered as members of amateur boxing clubs tripled between 2005 and 2009, and during the same period the number of schools including boxing in their curriculum increased from 20 to 1,931 [20]. This was at least partly a consequence of a high-level political decision that amateur boxing, which previously had been regarded as too violent to qualify

for substantial public funding, was in fact a relatively safe sport capable of yielding important social benefits. If there is strong consensus that amateur boxing is safe and is meeting community needs and standards, the case for developing a new form of boxing may be weak. However, many medical groups continue to oppose all existing types of boxing [21, 22], and there is increasing public concern regarding the long-term effects of repeated head impacts sustained in sporting situations [23]. There is also some opposition to boxing on non-medical grounds [24-26]. If a new form of boxing was able to successfully address the objections while preserving elements of the sport widely regarded as desirable, it could conceivably lead to further expansion of demographic reach. To assess the potential, it is first necessary to be fully aware of the current debate.

III. OBJECTIONS TO BOXING

Davis [24] has provided an excellent overview of some major criticisms of boxing, namely those relating to levels of attendant pain and injury, glorification of violence, the social effects of the sport and a fundamental intent to harm the opponent. While he concludes that only the last of these criticisms is logically sustainable, they each merit further scrutiny.

Also deserving of consideration are concerns that boxing might be exploitative of vulnerable young people [27, 28], and assertions that in civilised nations the sport is essentially in breach of legislation relating to assault and battery [25].

111.1 Risk of death or injury

There is unequivocal evidence that participation in boxing entails serious risk. Analysing the period between 1890 and 2007, Svinth[6] documented the deaths of 923 professional boxers and 293 amateur boxers through injuries sustained during competition or training, and noted that there were likely others for which records had not been found. Overall, 91% of the deaths resulted from competition. The average age of the boxers at the time of death was 23.1 years for the professionals and 20.5 years for the amateurs. The numbers of deaths in the 1980s and 1990s were lower than in previous decades, but between 2000 and 2007 there was an average of more than 8 per year – not greatly below the average of 10 per year calculated for whole 118-year study period. In 2005, a female amateur boxer died following a bout. The vast majority of boxing deaths have been due to head or neck injuries, with acute subdural haematoma apparently the most common cause [29].

In addition to the deaths, there have been documented cases in which major surgical interventions have enabled boxers to survive acute subdural haematoma but have not prevented remainder-of-lifetime incapacitation [29]. Acute injuries, however, are not the only source of concern. Repeated head impacts over a period of time can cumulatively give rise to chronic traumatic brain injury that manifests in progressive dementia, Parkinson's disease with associated tremor and loss of motor control, reduced ability to perform cognitive tasks, slurred speech, unsteady gait, depression and predisposition to irrational anger [30-32]. It has been estimated that the condition, popularly known as punch-drunkenness, develops in about 20% of professional boxers [33], with symptoms typically appearing 12-16 years after boxing career commencement. Associated pathological changes to the brain include cerebral atrophy, damage to the corpus callosum, loss of neurons, formation of protein plaques and neurofibrillary tangles akin to those seen in Alzheimer's disease and reduced cerebral blood flow (probably due to damaged blood vessels) [30, 32, 34-37]. The incidence of chronic traumatic brain injury in boxers is positively correlated with duration of career, number of bouts contested, age of retirement, ratio of losses to wins and time spent sparring [33]. In short, the extent of overall exposure to boxing influences the probability of developing the condition. It is believed that sustaining multiple concussions is a primary risk factor [38].

Classic symptoms of chronic traumatic brain injury associated with boxing are seldom seen in current or former amateur boxers apart from those with a very substantial history of involvement in the sport [33, 39]. However, this should not be interpreted as meaning that the problem is almost entirely confined to professional boxing. Recent research suggests that there is likely a continuum of injury related to degree of boxing exposure. Magnetic resonance imaging of the brains of 76 boxers showed that 38% of professionals, but also 11% of amateurs, had anomalies probably resulting from boxing [40].

Samples of cerebro-spinal fluid obtained from 30 amateur boxers one and six days after competition were found to have elevated levels of neurofilament heavy protein compared to levels seen in control subjects, indicating neuronal damage. A fortnight after competition, the readings for the boxers had declined but were still significantly above those of the controls [41].

Tanriverdi et al [42] observed raised levels of anti-hypothalamic and anti-pituitary antibodies in more a third of 61 current or former Turkish male amateur boxers but in none of 60 age-matched male control subjects, suggesting that head trauma experienced by the boxers had produced an auto-immune response that could compromise pituitary function. Taken together, the findings infer that the difference between professional and

amateur boxers in regard to occurrence of chronic traumatic brain injury relates only to the typical degree of injury. The same may well be true of associated functional deficits.

Ongoing improvements in the regulation and medical supervision of professional and amateur boxing might reduce inherent injury risks associated with the sport [43], but cannot eliminate them. For example, earlier stoppage of bouts when a boxer is visibly hurt could be somewhat protective but can be implemented only after the hurt has occurred. In some circumstances, a single forceful impact to the head can have devastating effects. Also, since 1920, at least 61 boxers have died after contests that they officially either won or drew [6]. This emphasises the fact that even acute catastrophic brain injury is not always immediately obvious. Cumulative, chronic injury is still more difficult to detect.

It has been claimed that, from a purely statistical viewpoint, amateur boxers are more likely to die in a car accident on the way to or from training than from injuries received in the ring [6]. Such assertions need to be very carefully examined, since valid comparison of risk would require consideration of the total amount of time spent in the activities under consideration. Certainly, the dangers associated with participation in boxing, either professional or amateur, are significant and should not be trivialised. At the very least, they should be clearly explained to people contemplating involvement.

111.11 Intent to harm

There are sports in which the number of deaths and serious injuries per year is greater than in boxing – motor racing and equestrian sports are among the examples [44]. In general, though, these other sports are not subject to anything like the degree of medical and wider public criticism that has been directed at boxing. The reason for the difference is the perception that boxing entails a clear intent to harm the opponent [24, 30]. It is argued that in the other sports, deaths and injuries are essentially due to mishaps, whereas in boxing the infliction of injury is what contestants seek to achieve as a fundamental aim of the sport. The logical conclusion of this argument is that catastrophic consequences associated with boxing cannot be seen as entirely accidental.

Some proponents of boxing vehemently dispute the proposition that the sport necessarily involves intent to harm [45, 46]. They contend that the objective in boxing is simply to land impacts on well-defined target areas of the opponent, and that boxing is in fact similar to other sports in that injuries are simply unfortunate and unwanted by-products of the pursuit of victory [46].

Notwithstanding the highly threatening verbal and physical demeanour frequently exhibited by professional boxers attempting to attract publicity in the lead-up to bouts, it is maintained that opposing boxers typically have no malice toward each other. Indeed, there are often displays of mutual respect and goodwill, such as the ‘touching of gloves’ at the beginning and end of rounds and the occurrence of post-bout acknowledgements and embraces. Strong and close personal relationships are often formed within boxing communities.

The existence of malice, however, is not prerequisite to intent to cause harm. It would be difficult to deny that most boxers enter the ring with a will to deliver forceful blows to the head of the opponent and to capitalise on any opportunity to render the opponent unconscious or at least unable to continue competing. Since it is known that these actions are likely to be damaging beyond the immediate moment, intent to cause harm is implicit even if not conscious or malicious.

Supporters of boxing may assert that there are many other sports in which athletes deliberately make forceful contact with opponents in an attempt to gain an advantage [45]. The difference, though, is that these contacts are generally incidental to pursuit of the objectives of the sport rather than being a primary aim. In most sports, deliberate forceful contact to the head of an opponent is expressly forbidden by the rules and, if perpetrated, incurs significant penalty. This recognises the danger of such contact and illustrates effort to prevent deliberate infliction of harm. In boxing, by contrast, potentially dangerous impacts are allowed by the rules and actively encouraged.

Davis [24] opines that, from moral and ethical standpoints, the objection to boxing on the grounds that it entails intent to harm is impossible to dismiss. He points out that, when a boxer senses that an opponent is hurt, adoption of body language indicating viciousness frequently occurs. The unavoidable conclusion that the sport involves intent to harm is thus reinforced.

111.111 Inconsistency with common law

Expert consideration has been given to the relationship of boxing to common law in the United Kingdom, Australia and, by implication, nations with similar legal frameworks [25, 47, 48]. There is unanimous agreement that boxing consists of activities that in other circumstances would clearly constitute the criminal offence of ‘aggravated assault’ and, in some cases, assault occasioning grievous bodily harm. Offences of this nature carry lengthy prison sentences. It is considered anomalous that a pursuit that has illegal activities as its core is not itself deemed illegal.

The apparent anomaly is made possible by the fact that boxing is recognised as an organised sport. The law holds that actions normally regarded as assault may not necessarily be so when they occur in formal sporting contexts [25, 47]. Boxing is therefore legal only because its standing as a sport is implied and affirmed in policy documents produced by government instrumentalities.

At least in the Australian state of New South Wales, these documents have been produced primarily to ensure adequate regulation of boxing, rather than being based on a detailed determination of its legitimacy as a sport. It has been contended that, if the statutory recognition was withdrawn, boxing participants would immediately become liable to prosecution [25].

Issues surrounding participant consent are integral to debate on whether boxing should continue to be regarded as a valid organised sport. It can be held that if participants freely consent to enter the ring in full knowledge of the inherent risks, they should have the right to do so [45]. Under common law, though, a person cannot consent to be the victim of an assault that causes injuries of anything more than a temporary and trifling nature [25, 47, 48]. This is based partly on the principle that even moderate injury has implications for people other than just the injury recipient and therefore contravenes the public interest. Beran and Beran[25] raise a question as to how boxing contestants, in contrast to other members of the community, can be permitted to consent to potentially debilitating assault.

From a legal perspective, consent must be informed in order to be acceptable – i.e., the person giving consent must have a genuine understanding of the risks to which he or she agrees to be subject. In addition, there must be opportunity for the person to withdraw consent at any time. Doubts have been expressed as to whether these conditions are routinely met in boxing environments [25]. Competency to consent and minimum age of eligibility to consent are factors requiring consideration, along with the possible effects of blows to the head on ability to make rational decisions regarding withdrawal of consent during a contest.

Leclerc and Herrera [49] point out that the matter of consent in boxing is complicated by the fact that a boxer effectively agrees not only to be a recipient of assault but also a perpetrator.

Over the past 150 years, there have been a number of court cases arising from boxing contests [25, 47, 48]. Most have occurred in the aftermath of the death or serious injury of a boxer. In general, it has been found that because boxing is conducted under strictly defined rules and is under the control of a referee who is in the ring with the contestants, it essentially entails a test of skills rather than an attempt by the contestants to knowingly harm each other. In an Australian case heard in the mid-1970s, the judge noted that if intent to inflict major harm could be demonstrated, boxing would be illegal [25, 47].

Brayne et al [47] point out that legal cases bearing on boxing typically have been resolved according to matters of public policy, and that no court has ever made a decision on the legality of boxing itself.

They suggest that potential exists to mount a test case in which unprecedented attention would be given to legal arguments and scientific evidence concerning the sport. In the opinion of Beran and Beran[25], recent irrefutable medical evidence demonstrating the long-term injurious effects of repeated impacts to the head means that in future legal cases it will be impossible to find that boxers do not knowingly seek to inflict harm on the opponent. They therefore believe that the grounds upon which boxing has been able to remain legal are becoming increasingly tenuous.

111.IV Glamourising violence

Inappropriate violence can be destructive to individuals, families and communities. Extensive scholarly effort therefore has been devoted to understanding its causes. There is evidence that some violent behaviour may have genetic and evolutionary foundations [50]. Implicit in the evolutionary process of natural selection is competition for passing on gene pools to subsequent generations. This entails ensuring survival by obtaining adequate shares of available food and other resources, establishing position within the community, vying for reproductive mates, protecting biological offspring and defending and/or expanding territory [51]. Insights into the methods by which these imperatives have been pursued throughout human history have been sought via studies of the current social systems of other primates - particularly those with the closest genetic relationship to humans. In these populations violent behaviour toward other individuals is much less frequent than cooperative and affiliative behaviour, but does form one end of a continuum of activities that can be seen as part of the function of competitive natural selection [50, 52]. The vast majority of violent and aggressive behaviour is perpetrated by males of reproductive age, an observation that applies also to humans and accords with the fact that this group has the greatest scope for passing on its genes [50]. It is possible that, during much of human evolution, genetic characteristics predisposing to aggressive and violent behaviour have favoured transmission of the gene pool and thus have become increasingly common, particularly among males [51].

Recent human research in molecular genetics has identified several genetic mutations that appear to be associated with inclination to violence, primarily through effects on production and/or responsiveness to neurotransmitters [51, 53, 54].

Based on the above, it can be argued that a tendency to sometimes act in violent ways is fundamental to the human condition, but this does not mean that violent conduct is acceptable in modern society. Violent impulses can be inhibited by human intellect, compassion and empathy [50]. In essence, violence may have a biological underpinning, but its expression appears to depend on complex socio-cultural factors.

Several somewhat overlapping explanatory theories have been developed in relation to the socio-cultural effects. One holds that much violence results from social inequality [55], with individuals higher in the 'pecking order' seeking to exploit those below them, and the latter rebelling against their position. Another theory points to the emergence of groups with sub-cultures in which violence is seen as a permissible and necessary means to an end [56]. Examples include organised crime syndicates and street gangs.

A widely recognised explanation for violent behaviour derives from the theory of social or observational learning [57], which suggests that many behaviours are learnt through seeing them modelled by others and then imitating them. The likelihood of imitation is influenced by observation of rewards or punishments received by the models – an effect known as vicarious reinforcement [58]. Additional salient factors include the extent to which the modelled behaviour captures the attention of the observer, the perceived relevance of the model, the ability of the learner to discern and reproduce the key features of the model, and the nature of any direct feedback resulting from the imitation [59]. The cognitive state of the learner, the perceived significance of the modelled behaviour and the characteristics of the learning environment therefore interact in shaping the learning experience. There is 'reciprocal determinism' in that the social environment affects the learning which in turn influences the ongoing nature of that environment [57]. It has been reported that people who consistently observe violent and aggressive behaviour within their social context are much more likely than others to adopt that behaviour [60].

It follows that social learning theorists are generally opposed to the modelling of violent actions, particularly in situations where those actions are overtly glamorised, rewarded and/or presented as fun. Movies, video games and advertising materials that involve graphic depiction of violence are seen as being counter-productive to attempts to develop harmonious communities [61], especially when viewers are encouraged to identify with the perpetrators of the violence rather than the victims. Inevitably, sports are also subject to scrutiny, with boxing at the forefront of criticism [61].

It is asserted that boxing models savage fist-fighting in which contestants aim to render each other unconscious. Because it is typically conducted in a colourful environment and the winner is accorded hero status while the pain and suffering of the contestants is largely ignored, there is thought to be a high likelihood of imitation and a risk of flow-on to violent behaviour in other circumstances.

Davis [24] points out that boxing does not model violence in general but only that specifically involved in boxing. He considers it doubtful that a society without boxing would be noticeably less violent than one that includes boxing but is equivalent in all other respects. Further, a case can be made that outside of the ring some boxers model behaviours that could decrease the probability of imitators becoming participants in social networks that foster multiple forms of major violence. There is, though, a quite strong school of community thought that boxing, together with other models of glamorised violence, could have negative effects on attempts to build societies in which there is minimal physical threat to citizens [30, 61].

111.V Exploitation of participants

Boxing is frequently condemned as a vehicle for blatant exploitation of underprivileged people by profit-hungry entrepreneurs [10, 62, 63]. According to this view, young prospects are lured into the sport through deliberate encouragement to dream of fame and escape from poverty.

Once recruited, they are eventually induced to engage in brutal public fights that entail a high likelihood of severe injury and even a possibility of death, all so that boxing marketeers, boxer agents and gambling organisations can make large amounts of money [64]. The marketeers cynically use less talented and declining boxers to build the win:loss records – and particularly the knockout statistics - of rising stars who as a result become highly valuable commercial commodities [64-66].

A few exceptionally gifted boxers do realise their initial dreams, but for a much greater number it inevitably turns out to be a highly painful and destructive illusion [67]. Even for those who become champions, success is often fleeting [65] and the subsequent fall can be precipitous, injurious, bewildering and lonely.

For some boxers, early career favours received from seemingly generous marketeers and agents create contrived indebtedness that can make escape from the sport difficult. Boxers can effectively become possessions of other people [10]. There is a history of association of organised crime with boxing [30, 63] and this can add to the complexity of the situation.

A group of Afro-American professional boxers studied by Wacquant[28] recognised their corporeal exploitation and described it as having parallels with prostitution, slavery and animal husbandry. The boxer-manager relationship was likened to that between prostitute and pimp and the boxer-marketeteer relationship was

seen to resemble that between slave and plantation manager. The boxers perceived that they were treated as livestock.

Nevertheless, they regarded their exploitation as normal and this, combined with other practical beliefs, arguably made them complicit in it.

Sugden[27] notes that boxing gyms tend to be concentrated in areas of high socio-economic disadvantage. He rejects claims that this reflects altruistic desire to use the sport as a means of diverting young people from juvenile delinquency and anti-social behaviour, instead believing that it is based on ensuring access to recruits who are vulnerable to exploitation.

Although allegations of exploitation pertain primarily to professional boxing, Sugden[27] contends that amateur boxing cannot be excused since it essentially serves to enable training and grooming of potential professional boxers and hence forms a vital part of a fundamentally exploitative and morally corrupt network.

There are of course some people in the boxing industry whose motives are demonstrably honourable, but many social commentators believe that the industry as a whole is exploitative [10].

IV. CALLS FOR BOXING TO BE BANNED

Numerous medical organisations around the world have formally documented their opposition to boxing and have called for it to be banned. Included here are the World Medical Assembly [68], the American Medical Association [21], the British Medical Association [69], the Canadian Medical Association [70] and the Australian Medical Association [22]. These bodies advocate the abolition of boxing in all its forms. In addition, the American Academy of Pediatrics and the Canadian Pediatric Society have stated their opposition to boxing as a sport for children and adolescents [71].

Professional boxing was banned in Sweden in 1970 but reinstated in 2007. In 2013, the Swedish Government announced that the sport was again under review following a near-fatal injury to a female professional boxer [72].

In Norway, a ban on professional boxing was implemented in 1981, but in 2013 the Government announced an intention to rescind it [73]. In 1991, a proposal to abolish professional boxing in Britain was defeated in the House of Lords by a margin of just three votes [74].

Warburton [45] argues that calls for the criminalisation of boxing are based on paternalistic, anti-libertarian attitudes supported by dubious legal moralism. He questions the right of the medical profession and legislative bodies to interfere with individual autonomy, even if a case can be made that boxing causes brain damage. In his opinion, an education campaign aimed at raising individual and general public awareness of the risks would be a more appropriate approach, and would be consistent with actions that have been taken in relation to other potentially damaging activities, such as smoking and alcohol consumption.

On the other hand, Leclerc and Herrera [49] contend that boxing is at odds with the central focus of libertarian philosophy – that of protecting individual autonomy – since the effects of the sport on the brain may eventually reduce the ability of the boxer to direct his or her own life.

They suggest that physicians should cease providing direct support to boxing competitions, since such support lends the competitions an unmerited air of medical and ethical legitimacy. Brayne et al [47] have pointed out that refusal of medical attendance at boxing matches could effectively result in banning of the sport, since regulatory policies generally require a medical presence.

A frequent argument against the prohibition of boxing is that such action would do nothing more than force the sport underground where it likely would be conducted in a much less regulated and more dangerous way [45, 75]. A counter-view, though, is that the same logic could be used to justify re-introduction of legalised slavery [25].

While the above indicates that during recent decades the impetus for banning of boxing has been significant, it appears that at present the medical and other objections to boxing are being over-ridden by a more persuasive narrative.

Part of that narrative may concern potential to generate large-scale economic activity [76], but it is germane to identify other elements that are commonly advanced.

V. THE CASE FOR BOXING

Boxing proponents have not been confined to just defending the sport against objections. Rather, they have proactively argued that boxing has many positive features, including some that make it well-placed to help governments address important contemporary issues beyond sport. A key theme is that boxing provides a medium for reaching and influencing lower socio-economic sectors of the population, where health and social problems are most prominent. Townson[77] notes that in Britain societal changes that occurred during the 20th century diminished involvement of the ‘working classes’ in sports that were previously their domain.

Boxing, though, has continued to draw the vast majority of its participants from the lower socio-economic category and has been described by Shipley [78] as 'the most proletarian of all sports'. It is accessible even in densely populated urban areas where few sporting facilities are available, allows relatively large numbers of people to train within small spaces and can be undertaken without expensive equipment. Some of the commonly advanced attributes of boxing are outlined next.

V.I Development of Physical Fitness

Boxing is an excellent activity for building general physical fitness. The physiological characteristics of high level boxers provide insights into the demands of the sport. National male amateur boxing squads from France, Germany and England have recorded average maximum oxygen uptakes in the vicinity of 60-65 ml.kg.min⁻¹[79-81], indicating high aerobic capacity. This is similar to values reported for male professional soccer players [82] and far above the 42-46 ml.kg.min⁻¹ that is considered 'good' for 20-29 year-old males [83]. Punch forces of senior male English amateur boxers measured in a laboratory situation averaged over 2600 Newtons for the dominant hand, and over 1700 Newtons for the non-dominant hand, reflecting extraordinary neuromuscular capability [81]. Post-bout blood lactate measurements on 75 international amateur boxers competing over four 2-minute rounds produced a mean value of 13.5 mmol.L⁻¹[81]. This demonstrates that competitive boxing also requires highly-developed anaerobic capacity.

Preparation for boxing thus mandates participation in intensive exercise sessions that target and enhance multiple physiological systems and muscle groups. The effectiveness of typical sessions has been objectively shown [84] and has resulted in widespread community adoption of boxing training methodologies for fitness development [85, 86].

Increasing incidence of disorders such as obesity, diabetes and cardio-vascular disease – all of which can result from and/or be exacerbated by sedentary lifestyle - is of major global concern [87]. Boxing is currently providing the foundation and stimulus for a wave of exercise programs that at least in a small way may be contributing toward efforts to arrest and reverse the trend.

V.II Character Building

It is popularly claimed that boxing, by its very nature, fosters the development of positive character traits among its participants [88]. Self-esteem, self-discipline, courage, perseverance, resilience, respect for others, and willingness to comply with rules are all sometimes identified as personal qualities that are likely to be improved through involvement in the sport, and there is a pervasive belief that the effects transfer to other aspects of life [88].

Upon initial scrutiny, scientific support for these claims appears scant. Bačanac[89] compared the psychological profiles of 104 experienced senior Yugoslav boxers who were vying for national selection with the profiles of 277 equally competitive athletes from other sports. The boxers were found to be relatively low in self-confidence, conscientiousness, reliability, responsibility, sociability, recognition of moral norms and desirable standards of behaviour, feelings of acceptance, and propensity to critically analyse problems. They were more likely to neglect rules and obligations, more reserved, and more inclined to guilt and self-reproach. Some of the personality traits were detected also in a group of much younger boxers, suggesting that they might have influenced the choice of sport rather than resulting from the sport. The low socio-economic background of boxers was thought to be a major factor influencing their profiles, and the research findings do not exclude the possibility that involvement in boxing might still have shifted at least some of the personality traits in a positive direction.

There is debate as to whether sports participation in general has character-building effects, and instances of athletes using prohibited performance-enhancing drugs, cheating in other ways, abusing officials, assaulting opponents and committing crimes outside of the sporting arena are sometimes cited as evidence to the contrary [90]. Current expert opinion is that sport does not inherently build character, but can do so if the experience is structured in a way that places an imperative on specific behaviours and provides appropriate role models. Calling upon social learning theory, Omar-Fauzee et al. [91] emphasise that the ways in which sports participation influences attitudes and behaviours depend on the nature of both the learner and the learning environment. Boxing, therefore, may help to build desirable character traits, but is likely to do so only in circumstances where those traits are very clearly valued, modelled and rewarded. For many boxing participants, involvement with a boxing club does at least offer a possibility of encountering such circumstances in a context perceived as relevant and therefore worthy of attention. Other aspects of their lives might offer very few comparable possibilities.

V.III Social benefits – Hope, Opportunity and Pride

To understand the potential social impacts of boxing, it is useful to consider the perspectives of boxers. Wacquant[92] conducted a comprehensive ethnographic study over a three-year period during which he became

integrated into a boxing gym in a Chicago ghetto and interacted with almost all professional boxers in the area. Despite awareness of exploitation, the boxers (all males) were very willing participants in the sport and the great majority professed to love boxing. This attachment could not be explained in financial terms, since few were making much money from their participation and many were fitting boxing around other paid commitments. Their initial engagement was typically motivated by hope of escape from poverty and belief in a possibility of becoming a world champion, but even when (in most cases) it subsequently became apparent that these goals would not be attained, the boxers chose to continue involvement due to perception of other benefits.

Receipt of acclaim and respect from within 'the small neighbourhood' of family, friends and associates was important. The most critical factor, though, was access to a world very different from that of the ghetto and the opportunity to develop a new and transformed 'hyper-masculine' self. The boxing world was seen as offering the prospect of a career in which advancement depended on talent, hard work and willingness to sacrifice distracting pleasures.

It was felt that success in boxing required not just honing of the body to meet the demands of the sport but also the deployment of highly technical skills that could be acquired only through many years of rigorous, dedicated practice. The boxers took pride in their technical mastery – their socio-economic circumstances meant that outside of boxing they were largely confined to unskilled, repetitive jobs. Participation in boxing also provided them with greater personal autonomy, variety of experience and excitement than they had been able to find in the standard labour market. They recognised the risk inherent in the sport but considered it less than the ever-present danger on the streets outside.

The Chicago boxers subscribed strongly to the organisational ethics of the gym in which they trained [92]. Central to the ethical framework was that boxers should never fight other than in the ring against properly prepared opponents.

Also notable was a view that quite marked asceticism - incorporating dietary restrictions and abstinence from alcohol, cigarettes and other drugs – was fundamental to the life of a boxer during periods of intensive training. As a result of these ethical commitments, the boxers were largely divorced from the gang warfare and the drug culture and commerce that pervaded their local community. They found delight in being identified as role models for children from the community and in exemplifying the viability of a quest for a better life.

Most of the boxers studied by Wacquant[92] thought that they had derived substantial net benefit from their participation in the sport, with less than 10% believing that they would have been better off if they had never become involved. While individual benefits are important in their own right, their sum might yield wider social good by signalling that there are legitimate and realistic channels through which hope, opportunity and pride can be pursued even in the midst of concentrated urban dereliction. It can be argued that in the 'urban jungle' the existence of boxing clubs might act as a force for reduction of overall social violence.

Wacquant[92] did observe, however, that underneath the surface many of the Chicago boxers were troubled by contradictory feelings about their sport - over 80% of them indicated that they would not want their children to engage in it.

Fulton [93] carried out an ethnographic study with male boxers and members of the boxing industry in the north-east of England, where he became associated with an amateur boxing club and served as a judge at numerous boxing tournaments. His findings were similar to those of Wacquant[92] in that the boxers saw the sport as providing them with considerable benefits. Fulton [93] categorised these benefits as 'social capital' arising largely from the strong camaraderie that was present in the sport and the resultant formation of social networks that could be called upon outside of boxing. The generation of this capital seemed to depend on expression of attitudes and behaviours that reinforced male hegemony, but it was noted that the recent rapid increase in female boxing participation might change the situation. The social capital established by the boxers, although valuable, was only seldom translated into 'cultural' capital, defined as assets valued by the current ruling classes.

Because of its evident ability to attract the interest of young people in disadvantaged communities, boxing is at the centre of a range of programs aimed at influencing these young people and providing them with knowledge and life skills that may help to overcome their disadvantage. Included here is the 'Fight for Peace' program [94] that arose in the slums of Rio de Janeiro, now has a major presence also in London and is targeting under-privileged areas around the world. Participants in this program are able to undergo boxing and martial arts training but, to remain eligible, must also engage in personal development activities focused in the areas of education, employability, youth services and youth leadership.

The initiator of the program has received a Laureus World Sports Award in recognition of its success [95]. In addition, boxing forms the core of a youth outreach program in another Rio slum [96] and has been an element of the Positive Futures program [97] implemented by the UK Government with a view to crime reduction.

V.IV Aesthetic qualities

It is sometimes argued that boxing incorporates profound aesthetic qualities that have worth in their own right [5, 65, 98]. The movements involved in highly skilled boxing may be seen as exhibiting grace, elegance, nuance, temporal rhythms, spatial relationships and combinations of synchrony and asynchrony that make them exquisite and beautiful.

Chandler [65] points out that the movements are highly evolved and stylised, and provide boxing with definition and structure that fundamentally differentiates it from street fighting and allows rendition of a visual narrative. In this regard, skilled boxing can be likened to ballet [98] – in both activities movement fluidity and perfection allow narrative to be communicated more powerfully. The boxing style of a current undefeated world professional champion has been described as ‘a symphony of movement’ [99] and the most popular boxer of all time, Muhammad Ali, famously summarised his own *modus operandi* as ‘float like a butterfly, sting like a bee’ [100].

The notion that skilled boxing can be beautiful is captured in the common description of the sport as, for example, the ‘sweet science’ and the ‘noble art’.

The aesthetic appeal of boxing, though, extends far beyond just the movements of the performers and encompasses elements of the setting in which they occur [5]. The ring, the ropes, the bell, the lighting, the brightly coloured clothes of the contestants, the attire of the referee, the ring stools and even the contours of the gloves have evolved in ways that add to the visual allure of the sport. Scott [5] suggests that – as in the world more generally – such ‘aestheticisation’ serves to draw attention to objects and actions that have deep symbolic significance. For example, the silks and satins of the boxers may symbolise a feminine connection to a domain in which, historically, males have strived to assert and confirm their masculinity.

Throughout its history, boxing has shown an extraordinary ability to inspire artists, including painters, sculptors, potters, photographers, graphic designers, poets, novelists and film makers. According to *Encyclopaedia Britannica*, ‘it is likely that more literary writing, as opposed to pure journalism, has been spent on boxing than on any other sport’ and fictional movies about boxers outnumber all other sports films [101]. The American essayist and cultural critic, Gerald Early, has noted that while boxing has prospered as a sport in mass industrialised society it has, surprisingly, also flourished as an aesthetic [102].

The vibrant interaction between boxing and the creative arts may relate at least partly to the fact that the dance-like qualities and colorful symbolism of boxing co-exist with real-life physical threat, uncertainty, and the constant possibility of a swift, destructive ending.

The writer Joyce Carol Oates comments that ‘Boxing has become America’s tragic theatre’ [62]. She proposes that there is no other sport in which ‘the connection between performer and observer is so intimate, so frequently painful, so unresolved’ and that the ‘theoretical anxiety’ associated with the sport is at the heart of its broad fascination. She believes that many boxing enthusiasts struggle with inner conflict related to a suppressed understanding that the sport, which can produce rare beauty, also has a potential for excruciating brutality [62]. The elemental incongruity is perhaps a stimulus for artistic interest.

Scott [5] argues that the professional and amateur versions of boxing are based on different but complementary views of the sport that reflect different aesthetic appreciations and moral constructions. It is undeniable that for some people who participate either actively or vicariously in boxing, the occurrence of knockouts and bloodshed is a real attraction.

The ranks of this group probably have been swelled by television coverage of professional matches. It appears, however, that there may also be a sub-group for which violence is nothing more than an under-current to beauty found in other dimensions of the sport.

The artistic works motivated by boxing mean that the sport has contributed to the recording, transmission and shaping of social history and culture, particularly during the past 120 years. This contribution should not be too readily dismissed.

V.V Catharsis

There is a popular view that boxing provides participants with a controlled outlet for natural aggressive instincts and impulses that if not released would predispose to violent behaviour in other circumstances [103-106]. This view is based on the Freudian concept that repeated suppression of emotions leads to progressive build-up of ‘pressure’ and that finding opportunities for socially acceptable discharge of these emotions is necessary to the avoidance of eventual pathology [107]. The process of socially acceptable discharge is termed ‘catharsis’.

It is sometimes suggested that the sport serves a cathartic function not only for contestants but also for spectators [108], since it enables release of their pent-up aggressive emotions. Current scientific evidence, however, does not support this notion.

Bushman [109] conducted a large study in which some deliberately angered subjects were invited to punch a bag while others did nothing. Within the punching group, half of the subjects were encouraged to think about their provocateur during the activity while the remainder were asked to focus on fitness development.

Afterwards, the subjects who undertook the bag-punching with the provocateur in mind showed the highest levels of anger and the most aggressive behaviour toward the provocateur, while those who did nothing following the initial stimulus to anger were the least angry and aggressive.

This result was opposite to that predicted by catharsis theory, and instead was consistent with cognitive neoassociation theory, which posits that aggressive thoughts can call up from memory complex associations of aggressive ideas, emotions related to violence, and impetus for aggressive actions.

Huang et al [110] compared athletes from high-contact sports with counterparts from low-contact sports and found that the former responded more aggressively to provocation, despite the fact that their sports might have been expected to offer greater catharsis. Also contrary to catharsis theory are the observations of Lemieux et al. [111], who used a questionnaire to determine self-reported hostile aggression for university athletes from high-contact and low-contact sports, and also administered the questionnaire to two control groups that were matched with the two sport groups on a range of variables including height and weight. Levels of hostile aggression were positively related to body size but were not lower in the athletes than the matched controls.

With regard to spectators, the majority of research indicates that watching a sport incorporating violence generally tends to increase rather than decrease subsequent aggressive behaviours [112]. This appears to be influenced by the attitudes brought to the situation, with the effect being particularly prominent among spectators who have greater preference for the violent aspects of the sport [113] and more likely to occur when spectators perceive that there is animosity between the sporting protagonists [114].

It remains possible that boxers have a relatively low predisposition to violence outside the ring, but if so it is likely due to fatigue produced by training, a dearth of free time and commitment to a sub-cultural code of behaviour [92], rather than to any cathartic effect of the sport. Similarly, there may be cases in which watching a boxing match provides a distraction from frustrating life stresses and yields a temporary net reduction in aggressive emotions [112]. It seems clear, though, that the idea that actual or vicarious participation in boxing entails quasi-therapeutic venting of submerged negative energy is untenable. Goldstein [112] points out that the theory of catharsis assumes that human emotions exist in finite quantities such that their use results in depletion, an assumption that is almost certainly incorrect.

VI. A NEW VARIANT OF BOXING?

The above highlights the point that while some very legitimate concerns surround boxing, the sport also has positive aspects. It therefore seems worth exploring whether it is any way conceivable that boxing could be modified to overcome the objections without loss of the benefits. There have been suggestions from various sources that impacts to the head should be prohibited [21, 25, 115, 116]. This single step would undoubtedly go a long way toward addressing the most strident criticisms of the sport.

Yet a ban on blows to the head may not necessarily be enough. One of the most fundamental and challenging objections to boxing – the existence of intent to harm – could still be seen to apply, since heavy body blows can be damaging. Consequently, other changes probably would be needed.

The American Medical Association [21] has recommended the development and deployment of impact-absorbing gloves. If a sufficient degree of impact absorption could be achieved, the possibility of inflicting harm would become minimal.

In making modifications, it would be important to ensure that the sport continued to demand high levels of physical fitness and retained its appeal to a significant sector of the population. Preservation of strong aesthetic qualities would be critical, and as part of this highly skilled performance would have to be encouraged and rewarded. Pearn [115] argues that the boxing without head impacts would still be an attractive spectacle, as the emphasis on skill might well be increased, but Smillie [76] suspects that for many boxing enthusiasts the appeal of the sport would be lost, and Zillman et al. [117] have demonstrated that likely occurrence of violence does increase spectator enjoyment of sports.

What is clear is that the required changes would be of monumental proportion, and probably would be subject to major resistance, since they would effectively create a substantially different sport [49]. Is it then unrealistic to even countenance them? Regardless of the scientific merits of the argument, it would be naïve to think that boxing authorities would spontaneously resolve to adopt radical reform, particularly at a time when the sport is riding a wave of popularity. It might be feasible, though, to progressively develop and implement a new variant of boxing, co-existing with the current versions, as a concrete exemplar of a direction that the sport could eventually take and as a means of gauging reaction from participants in the boxing debate and the wider public. Looking to the future, it is perhaps more likely that boxing authorities would endorse a ‘going concern’ than decide to venture into an entirely uncertain space, especially if the former had demonstrable grass-roots support. In short, there may be value in showing what change could look like, as opposed to simply advocating the need for such change.

A modified form of boxing incorporating characteristics similar to those recommended by the American Medical Association [21] has recently emerged in Australia. It is known as Box'Tag and is providing a useful test case. We have been part of the project team.

VII. THE BOX'TAG PROJECT

Box'Tag has evolved over an 8-year period [118] and is still undergoing refinement. Ability to gain insights from evaluation of the project requires understanding of the current nature of Box'Tag, the ways in which it has been promoted, the response to that promotion, possible next steps, and issues that have confronted members of the developmental team.

VIII. OVERVIEW OF BOX'TAG CONCEPT

The rules of Box'Tag prohibit impacts to the head or neck, as well as any impacts above a moderate level of force [119]. Nevertheless, contestants are required to wear head guards and mouthguards as protection against accidental head impacts. It is also mandatory for male contestants to use groin protectors and for females to use chest protectors. Target areas consist of the front and sides of the torso and small regions on the upper arms. The arm regions, which are not part of the target in conventional boxing, have been added in lieu of the head so that the overall size of the target area is retained [119]. Bouts are typically contested over three rounds of 1-2 minutes. Specialised gloves with enhanced impact-absorbing qualities have been produced and deployed in field trials.

From the time of its inception in 2006, Box'Tag has made use of automated scoring technology. The historical development of that technology has been described by Hahn et al [18] and Helmer et al [120]. Presently, contestants wear T-shirt style vests with a sensor fabric defining the scoring regions. The sensor fabric incorporates stripes of silver-coated nylon yarn through which a low-level electrical current can be run.

A small transceiver worn in a pocket at the back of the vest generates the current. Patches of conductive material are affixed to the gloves. When this material bridges two stripes on a vest a change in the electrical resistance of the vest occurs, enabling impact detection. Electrical resistance data are transmitted by Bluetooth to a ringside computer, where a customised software package applies various algorithms to determine whether a point should be registered [119]. Scores can be displayed in real time. An operator of the ringside computer can manually deduct points from competitors at the behest of the bout referee, who can impose penalties for inadvertent head contacts, excessively forceful punching or inappropriate behaviour. The accuracy of the scoring technology has been confirmed by empirical research [121].

VII.II. Promotion of Box'Tag – the issue of 'push' vs 'pull'

The impetus for the development of Box'Tag has determined the manner of its promotion. The development did not originate from an identified market demand. Indeed, a recent survey of a sample of Australian health and fitness club members suggested that there is presently no large-scale market 'pull' for a modified form of boxing (Boxing Australia Limited, personal communication). The focus, then, has been on building a basic capacity for practical demonstration of Box'Tag. In effect, there has been a fairly low-profile 'push' aimed at capturing interest, but no advertising campaign or attempt at commercial roll-out.

Initially, a Box'Tag program was established at just one boxing and fitness club in Sydney [118]. Club members trained for Box'Tag competitions that were held approximately quarterly, and usually consisted of 8-14 bouts. Outside of this, one-off demonstrations were occasionally provided to interested groups. In 2010, a number of key people from the Australian sports industry accepted an invitation attend to a Box'Tag demonstration at the Sydney club. Included here were several representatives of Boxing Australia (the organisation responsible for national control of amateur boxing).

During the past four years, Box'Tag programs have been selectively introduced also in several locations outside of Sydney [119], namely Melbourne, Canberra, and the New South Wales coastal town of Ulladulla. While this has occurred only within the confines of an expanded demonstrator concept, it has led to an increase in the overall number of competitions and opportunities for demonstration. A few Box'Tag competitions have been held for recruits at the Victoria Police Academy in Melbourne, and single competitions have been run by request in each of four New South Wales regional towns. Demonstrations have been provided at Open Days for two universities and the Queensland Academy of Sport, and at two Australian sport expos.

In 2011, an opportunity was taken to run a pilot Box'Tag program at a school in a disadvantaged area of Brisbane [122]. In 2012, a Box'Tag competition was included in the Victorian Police & Emergency Services Games. It was retained in 2013, and in 2014 it was added to the program for the Australasian Police & Emergency Services Games.

Box'Tag has been the subject of six publications in the scientific literature [18, 118-122], five presentations at scientific or sports industry conferences, a presentation to a group of talented young scientists, and several presentations to undergraduate university students. In addition, it has featured in three different

television science shows, although these have concentrated more on the scoring technology than on the Box'Tag concept itself.

Although the extent of promotion has been limited, it has perhaps been sufficient to enable a reasonable assessment of response.

VII.III. Indications of interest

Reactions of people directly exposed to Box'Tag generally have been favourable. The Sydney club at which the modified sport was first established has maintained its enthusiasm over eight years and still runs regular competitions. The Canberra Box'Tag program has grown tenfold from a small beginning to now include over 100 members. In Melbourne, the club at which Box'Tag was introduced has changed ownership but has continued to run a small Box'Tag program. The Ulladulla program is in its early days but appears to be thriving.

Boxing Australia has formally endorsed Box'Tag as a positive vehicle for community engagement [119] and is contributing to its development.

A leading Australian paediatrician has actively advocated for Box'Tag [118], as have three very well-known former champion boxers. The pilot Box'Tag program conducted in Brisbane attracted a very high rate of uptake from eligible students and achieved good program adherence [122].

Almost every club at which a Box'Tag demonstration has been held has subsequently expressed interest in implementing a program. In addition, there have been communications of interest from all states and territories of Australia. Enquiries have been received from overseas nations [119] including New Zealand, Tonga, England, Ireland, Canada, Poland, Dubai, Bermuda and the Bahamas.

The response has not been universally positive. A few attendees of Box'Tag competitions and demonstrations have commented that 'this is not boxing' and there has been some criticism that Box'Tag requires development of a skill set that differs importantly from that required for conventional boxing. The early prototype impact-absorbing gloves have been considered uncomfortable and unnecessary by some Box'Tag participants. Although Box'Tag competitions have occasionally attracted audiences large enough to fill the small arenas in which they have been held, the audiences have consisted mostly of the family and friends of the contestants. This suggests that in its current form the modified sport might have relatively little spectator appeal.

Overall, though, the feedback has perhaps been sufficiently encouraging to justify a belief that reasonable community traction could be achieved by a version of boxing that addresses medical and other concerns regarding the conventional forms of the sport.

Within the clubs hosting Box'Tag programs, many of the participants would never have contemplated involvement in the conventional form of the sport [119]. Outside of those clubs, the interest has come primarily from people involved in conventional boxing, although some athletes from other sports have used Box'Tag for cross-training.

VII.IV. Next steps

A logical next step would be to capitalise on the interest that has been generated by moving from the demonstrator approach to a more substantial field trial entailing early roll-out of the modified sport. If Box'Tag maintains its current form, this would require an ability to ensure cost-effective supply of the wearable technology that permits automated scoring. To date, all of the vests and transceivers have been hand-made by a research agency [120], entailing significant expense. Cost minimisation, perhaps through bulk production of equipment by a commercial manufacturer [119], will be essential to reaching the demographic sectors from which boxing participants have been almost exclusively drawn [77].

A question naturally arises as to whether Box'Tag would be viable without the scoring technology. Box'Tag participants and spectators have generally opined that the technology is integral to the appeal of the modified sport [118]. It might, however, need at least to be scaled down to optimise potential for Box'Tag expansion.

From a research and development perspective, attention will need to be directed to ongoing refinement of impact-absorbing gloves to improve the degree of impact absorption and provide a level of comfort that is universally acceptable.

If a larger field trial of Box'Tag is to be conducted, development of strategies for raising public awareness of the modified sport also will be necessary.

VII.V Confronting issues

During development of Box'Tag, the project team has encountered several issues that require serious reflection. On the surface, Box'Tag appears to be exempt from the primary objections to conventional boxing, since it involves minimal risk of injury and no intent to harm. It also provides for retention of most of the identified benefits of conventional boxing. It has been shown to demand high levels of physical fitness [123] and, if appropriately structured, should be as good as conventional boxing for character building. It could be

very well-suited to social outreach purposes, although there would need to be an investigation of its ability to attract adolescent and young adult males, who seem attracted to violent sports as a way of demonstrating their masculinity [124]. When performed with skill, it can have excellent aesthetic qualities. Yet there seems a possibility that the attempt to satisfy two groups that currently have opposite views of conventional boxing could end up satisfying neither.

In contrast to comments occasionally received from members of the boxing community, some people from outside the sport have expressed the view that 'Box'Tag is still boxing', and this view has affected ability to obtain support. It is noteworthy that the recommendations made by the American Medical Association [21] for modification of boxing come with the caveat that they should apply only for an interim period until all boxing is banned.

This implies that even a very low-risk form of boxing would not be acceptable. Perhaps many people have doubts about the ethical legitimacy of any activity in which contestants deliberately strike each other, even when there is little possibility and no intent of harm. If this is the case, further pursuit of the Box'Tag project might be futile. The extent to which Box'Tag (or a similar initiative) is likely to be backed by medical and other experts opposed to conventional boxing needs to be ascertained.

Another perplexing issue relates to the potential for Box'Tag to simply become a pathway into amateur and then professional boxing, rather than emerging as an alternative. According to logic outlined by Sugden[27], this would make it subject to the very objections that it has been designed to address.

Among members of the boxing community who have shown interest in Box'Tag, there has been a common view that it offers an excellent way to provide people with a first experience of the sport. Already, several people who started in Box'Tag have moved to amateur boxing.

It is not known whether this trend will continue. It may be that Box'Tag will become a niche version of boxing that for the most part attracts a demographic different from that of the conventional form of the sport, and one that has little interest in making the transition, particularly if not specifically encouraged to do so. Regardless, Box'Tag will need to achieve reasonable critical mass in order to be able to offer a pathway and suitable rewards in its own right. Until a roll-out of the modified sport is attempted, it will be difficult to tell whether this is a realistic vision.

Some concern has arisen that the attempt to develop a modified, low-risk form of boxing might be entirely counter to contemporary sociological trends affecting sport. A recent study [125] suggested that during the next 30 years there is likely to be a rise in the popularity of high-risk, high-adrenaline sports that are presently regarded as extreme. Goldstein [126] has noted that Western society seems to be embracing increasingly violent forms of entertainment. These trends are perhaps reflected in the current boxing boom and the recent emergence and media uptake of activities such as Ultimate Fight Club. It is pertinent to consider whether an initiative like Box'Tag has any genuine chance of success in this sociological context. There is, however, evidence of a co-existing impetus to improve sport safety. Many parents are discouraging their children from playing sports with a high perceived risk of injury [127]. Public officials are concerned about the effects of sports injuries on health costs. Earlier this year, the US House of Representatives Energy and Commerce Committee convened a special hearing on improving sports safety with a particular focus on brain injuries [128]. It therefore seems that there may be an ongoing sociological rationale for the development of Box'Tag.

VIII. Conclusion

We conclude that while there are some valid objections to boxing, the sport also has some positive elements. It is possible to devise a form of the sport that overcomes the former while retaining most of the latter. Such a form is capable of capturing and maintaining some community interest. Imbuing the modified sport with a technological component that makes it more than just boxing without head impacts probably increases its appeal. The results of preliminary field trials with a modified, low-risk form of boxing suggest that a larger trial may be justified. Success of a larger trial is likely to depend on the degree of medical, scientific and other support that can be obtained. The trial would have to be carefully planned to ensure that an assessment could be made of the potential of the modified sport to achieve the purpose for which it was designed, rather than just subsidiary purposes.

Further fieldwork on a modified form of boxing will need to be surrounded by research. Refinement of specially designed impact-absorbing gloves is required as part of a quest for continuous improvement of safety. Equipment costs will have to be reduced, and an understanding of demographic and socio-cultural factors associated with uptake of the modified sport will need to be sought.

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